



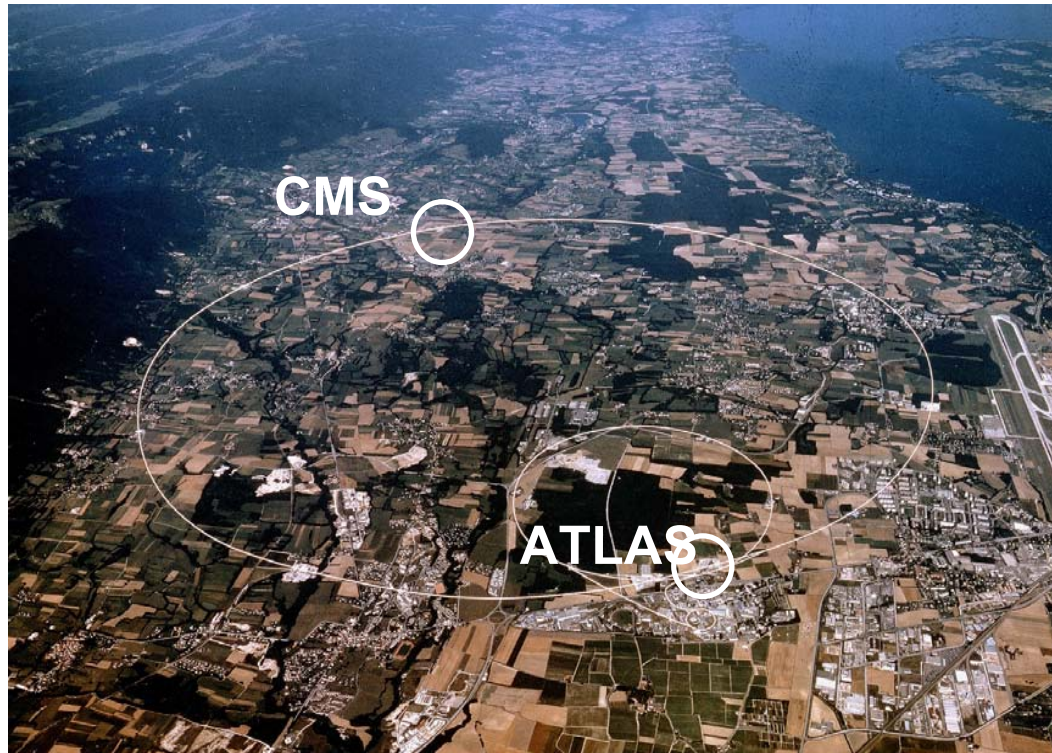
# **CMS Virtual Control Room - some thoughts -**

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**U of Maryland**  
**12-Sep-2003**

**Remote Operation & Monitoring**



# The LHC



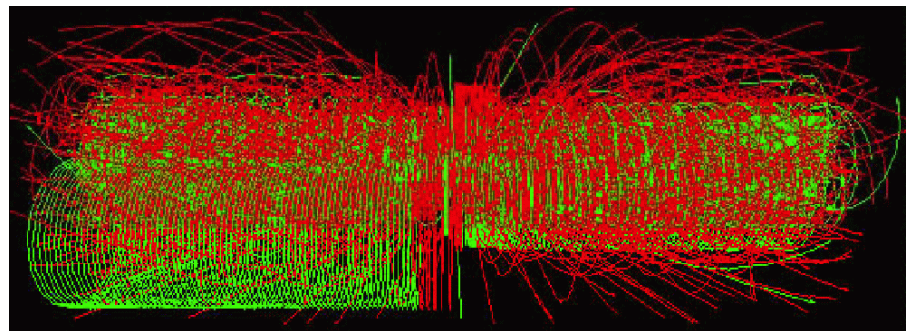
$R = 4.5 \text{ Km}$   
 $E = 7+7 \text{ TeV (pp)}$

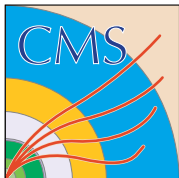
crossing rate  
 $= 40 \text{ MHz}$   
(25 nsec)

design luminosity  
 $= 10^{34} \text{ cm}^{-2} \text{ s}^{-1}$

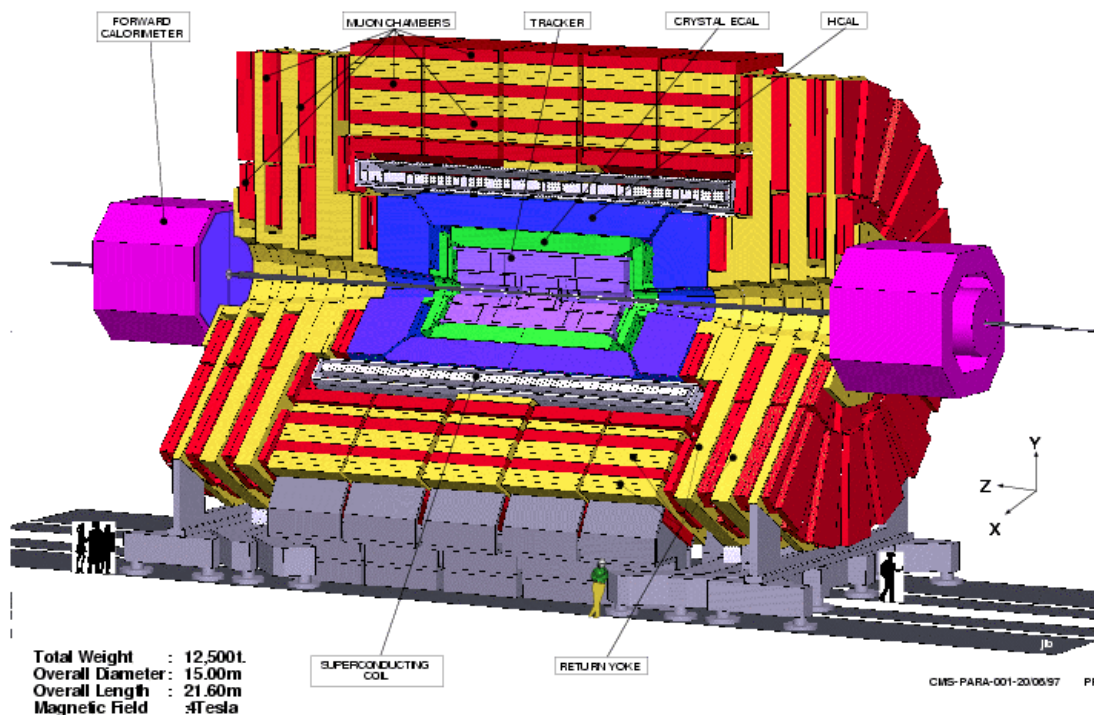
~20 pp interactions  
per crossing  
at design luminosity

$h \rightarrow 4 \mu$  with 20 min. bias evt.





# The CMS detector



Total weight	12500 t
Overall diameter	15 m
Overall length	21.6 m

**All silicon tracker**  
 micro strips (10M ch)  
 pixel (40M ch)  
 (5.4m long, 2.4m  $\Phi$ :  $|\eta| < 2.4$ )

**Hermetic calorimeter**  
 ECAL: PbWO<sub>4</sub> crystal  
 HCAL: brass+scinti.  
 ( $|\eta| < 3.0$ )

**in 4 Tesla solenoid**  
 (12.5m long, 6m  $\Phi$  in)

**Robust muon system**  
 DT+RPC (barrel)  
 CSC+RPC (endcap)  
 (in iron yoke:  $|\eta| < 2.4$ )

**Fast cerenkov calor.**  
 quartz fiber  
 ( $3 < |\eta| < 5$ )





**Surface buildings and main shaft**



**HCAL barrel**



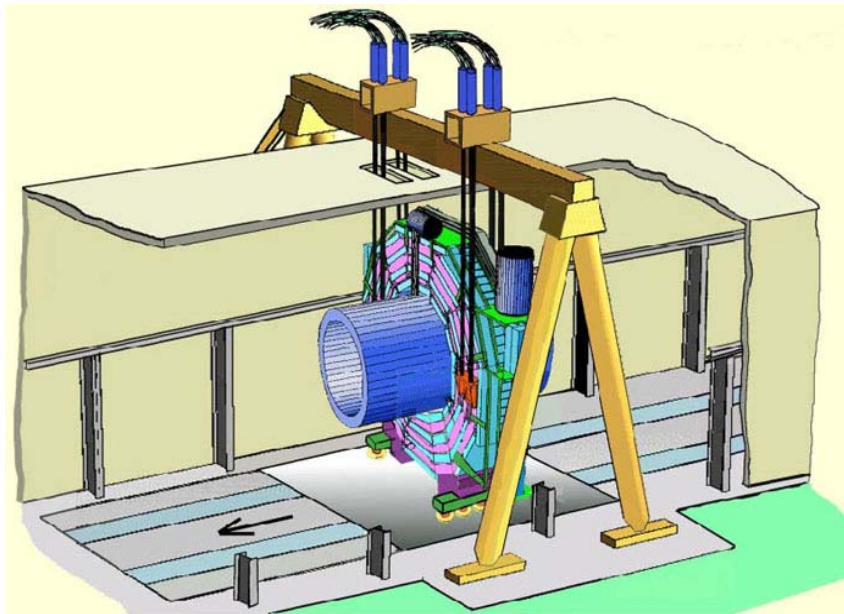
**Muon barrel yoke**

**Installation of the first muon chamber**



**HCAL/Muon endcap**





**Transfer YB0 (2000t) in 2005**



# HCAL plan

## 2003 June-September

- Calibration runs in the H2 testbeam at CERN (TB2003)
  - All HCAL subdetectors: HB, HE, HF, HO + Crystals

## 2004 Summer-

- Low energy testbeam at H2 (TB2004)
    - EC+HC response to low energy beam
    - hadron showers at low energy
  - Slice test with EMU, TRIG and DAQ at CMS.
    - Full system test - hardware & software & operation
- Remote detector commissioning, debugging & operation
- “Full” database capability

## 2005

- Transfer HCAL to the under-ground experimental hall.

## 2006

- Test beam (?)
- Integration and commissioning

## 2007

- Physics data taking



# TB2003

## TB2003 operation.

- Three months data taking.
- Experts visited CERN for 1~2 weeks ( a little longer) to install and commission their detector components, e.g. electronics, DAQ etc.
- People (non-expert) at CERN operated the system.
- Experts debugged and fixed problems, remotely.
- Some people monitored quality of data, remotely.

## We used some tools for remote capability.

- web pages. E.g.

<http://hpslweb.cern.ch/frame/java/1.1/view110-java.html>

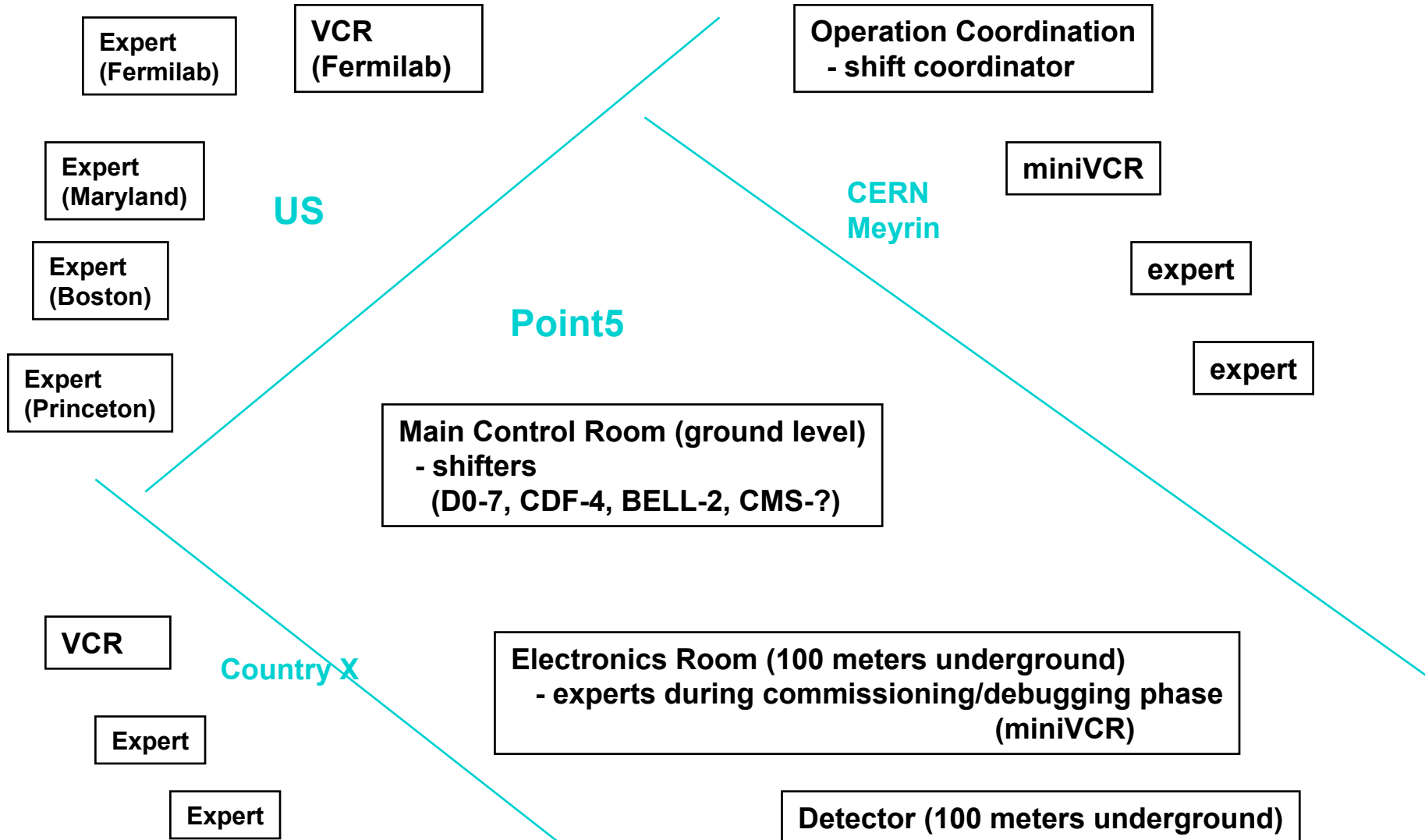
- e-logbook (provided by the HEPBook development team at Fermilab).
- 24h/7d VRVS connection.
  - \$100 Logitech camera + Polycom speaker/microphone in an analysis room.
  - a wireless head set and a wireless camera in a control room.
- daily meeting with experts in Boston, Princeton, Maryland, Texas, Fermilab etc.
- debug electronics/DAQ in the control room with experts.

## Missing:

- remote capability of detector slow control and monitoring.
- Plan to add these for TB2004 and the slice test.



# Operation of CMS







# CMS Control Room

## Main Control Room (Point 5)

### Video Screen



## Counting Room



?



## FNAL VCR

### Video Screen





# Console

ACC

VDV	ALG	ARM	EDS
OSV			DTM
DAQ		EM1	EM2
COM	INS	WK1	LGB

phone

chair chair

## Multi-displays/windows

**Work/Control**

**Instruction**

**Communication control and status**

**Video View**

**Oscilloscope view**

**DAQ/Trigger status**

**Alarm (detector monitor/event monitor)**

**Monitor 1 (detector monitor)**

**Monitor 2 (event monitor 1)**

**Monitor 3 (event monitor 2)**

**Monitor 4 (event display)**

**Accelerator/beam monitor**

**Accelerator logbook/ATLAS logbook**